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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/722,400	11/27/2000	Tianhong Zhang	2269-7144.2US (95-0813.02)	5784
24247	7590	10/03/2005	EXAMINER	
TRASK BRITT P.O. BOX 2550 SALT LAKE CITY, UT 84110			YOUNG, CHRISTOPHER G	
			ART UNIT	PAPER NUMBER
			1756	

DATE MAILED: 10/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/722,400

Applicant(s)

TAKEDA ET AL.

Examiner

Christopher G. Young

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 May 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 9-12, 27, 29-40 and 42-50 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 9-11, 27-33, 40 and 42-45 is/are allowed.
- 6) ☒ Claim(s) 12, 34 and 36 is/are rejected.
- 7) ☒ Claim(s) 35-39 and 47-50 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 November 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Drawings***

1. New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because the current drawings are of an informal nature. Applicant is advised to employ the services of a competent patent draftsman outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

### ***Claim Rejections - 35 USC § 112***

2. The use of trademarks/trade names has been noted in this application. It should be capitalized wherever it appears and be accompanied by the generic terminology.

Although the use of trademarks/trade names is permissible in patent applications, the proprietary nature of the marks should be respected and every effort made to prevent their use in any manner which might adversely affect their validity as trademarks/trade names.

3. Claim 12 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 12 contains a trade name for a specific polyimide. The particular formulation of this polyimide needs to be set forth in the instant specification to assure

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that one of skill can make and use the claimed invention in the event that the product is altered in the future.

***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

5. The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

6. Claims 34 and 46 are rejected under 35 U.S.C. 102(e) as being anticipated by Eaton et al., US Patent Number 6,012,336.

In FIG. 2j, a protection layer 54 can also be deposited to cover the electronic circuitry and interconnect metallization for use during an etch release step whereby the layers of doped silicate glass 28 and sacrificial material 30 are removed, at least in part, by a selective etchant comprising hydrofluoric acid (HF). The protection layer 54 can comprise any material that is substantially chemically resistant to attack by HF, including photoresist, polyimide, silicon nitride (e.g. deposited by PECVD), or tungsten. A photoresist, polyimide or silicon nitride protection layer 54 can be used when the selective etchant comprises a buffered oxide etchant; whereas a protection layer 54 comprising tungsten is preferred when the selective etchant comprises a more aggressive etchant such as a mixture of HF and hydrochloric acid (HCl) or a mixture of HF and water ( $\text{H}_2\text{O}$ ). The selective etchant can also comprise HF in a vapor form. The exact proportions of the constituents in each mixture can be adjusted to provide a predetermined etching rate for selectively removing the layers of doped silicate glass 28 and sacrificial material 30 while not substantially affecting the silicon substrate 16 or the protected electronic circuitry 14.

A tungsten protection layer 54 can be formed after initially depositing a thin passivation layer 50 (e.g. about 200 nanometers of a silicate glass such as PETEOS) to cover the electronic circuitry 14. The tungsten protection layer 54 preferably includes an adhesion layer comprising about 50 nanometers of titanium nitride (TiN) deposited by sputtering or CVD over the electronic circuitry 14. A thicker layer (e.g. about 0.1-1 microns thick) of tungsten (W) is then deposited over the titanium nitride layer (e.g. by CVD using  $\text{WF}_6$  as a source gas). This forms a two-ply protection layer 54 which

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has a substantial chemical resistance to the HF:HCL or HF:H.sub.2 O selective etchants to prevent any damage to the electronic circuitry 14 during removal of the layers of doped silicate glass 28 and sacrificial material 30. After removal, at least in part, of the layers of doped silicate glass 28 and sacrificial material 30, the tungsten-based protection layer 54 can be removed using another selective etchant comprising hydrogen peroxide.

After formation of the protection layer 54 in FIG. 2j, the protection layer can be overcoated with a thin layer (about 100 nanometers) of PECVD silicon dioxide or silicate glass (e.g. TEOS) to improve adhesion for a subsequently-formed photoresist layer (not shown). This photoresist layer is photolithographically patterned and used to dry a plurality of openings or channels 56 down through all the layers overlying the sacrificial material 30, thereby exposing the sacrificial material 30 for etching by the selective etchant comprising HF. The channels 56 are typically micron sized so that they can be later sealed.

In FIG. 2k, the layers of doped silicate glass 28 and sacrificial material 30 are removed, at least in part, by selective etching with the selective etchant comprising HF. The selective etching step (also termed an etch release step) can be timed to remove a predetermined amount of the doped silicate glass 28 and sacrificial material 30 as shown in FIG. 2k, or can proceed for a long time duration of up to several hours or more to remove substantially all of the doped silicate glass 28 and sacrificial material 30.

After the etch release step, the substrate 16 can be washed and dried and the protection layer 54 can be removed. The silicon nitride layer 38 overlying the upper

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capacitor plate 34 can also be removed, although this is optional and will generally depend on an overall thickness of the layers 32, 34 and 38 and a pressure range for use of the integrated device 10.

7. Claim 34 is rejected under 35 U.S.C. 102(b) as being anticipated by Campbell et al., US Patent Number 5,198,382.

The masking layer 14 is then etched whereby those areas of the masking layer 14 which are not coated with the photoresist layers 16 are removed by the etchant. When the masking layer 14 is composed of pyrox, as described above, the etching step is carried out by using a wet hydrogen fluoride based etchant. The lift-off layer 12 is then etched also whereby those areas of the lift-off layer 12 which are not covered by the masking layer 14 are removed by the etchant. When the lift-off layer 12 is composed of polyimide, the etching step is carried out by an oxygen plasma, or, alternatively, a strong oxidising acid such as nitric acid or sulphuric acid. The etching of the lift-off layer 12 is carefully controlled so that those portions of the lift-off layer 12 which are underneath the edge regions 18 of the masking layer 14 are removed thereby to undercut the edge regions 18 of the masking layer 14 and form an overhang or undercut 19 of the masking layer 14. The undercut 19 forms a re-entrant junction between the masking layer 14 and the lift-off layer 12. The photoresist layers 16 are then stripped away in known manner. The resultant structure is shown in FIG. 4.

***Allowable Subject Matter***

8. Claims 35-39 and 47-50 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. Claims 9-11, 27-33, 40 and 42-45 are allowed.

***Conclusion***

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Nagaya et al. set forth the state of the art in this area. However, the filing date of the instant application prohibits application of this patent as prior art.

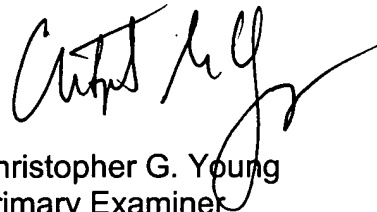
11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher G. Young whose telephone number is 571-272-1394. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read "Chris Young", with a long, sweeping horizontal line extending to the right.

Christopher G. Young  
Primary Examiner  
Art Unit 1756

cgy